RESEARCH DEPARTMENT

VISIT TO JERSEY AND NORMANDY TO INVESTIGATE CO-CHANNEL INTERFERENCE BETWEEN NORTH HESSARY TOR AND CAEN

Report No. A-062

(1961/16)

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SUMMARY

An investigation has been carried out in Jersey and parts of the Cherbourg peninsula to enquire into complaints that television reception in the service area of the French transmitting station near Caen was being affected by interference from the B.B.C. transmitter at North Hessary Tor.

A few days were spent in discussion and carrying out observations. As a result, it is concluded that an improvement can be achieved by making a small change in the carrier-frequency of North Hessary Tor.

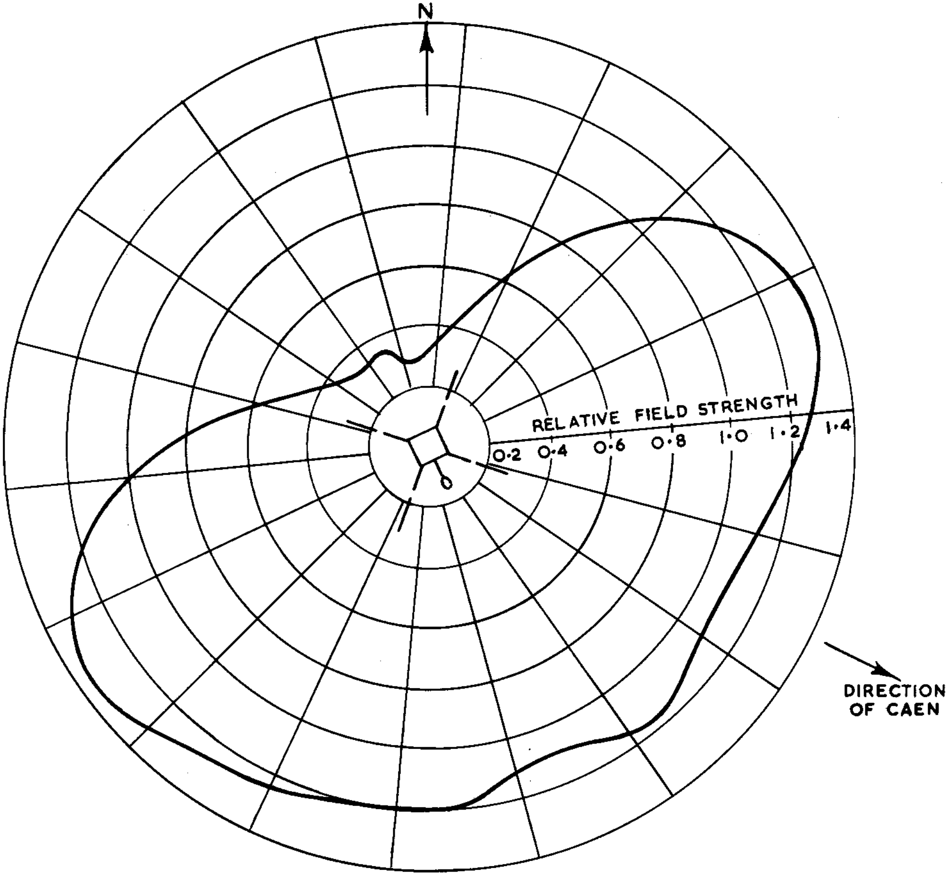
The report describes the visit and mention is made of some aspects which may be of general interest.

1. INTRODUCTION

Information had been received from Radio Télévision Française that a strong signal was interfering with television reception in the service area of Caen. It had been said that districts as close as 12½ miles (20 km) from the transmitter were being affected. From the evidence available, it appeared that the interference originated at the B.B.C. transmitter at North Hessary Tor in South Devon.

The effective radiated power (e.r.p.) of the Caen transmitter is stated to be 50 kW on a frequency of 52·4000 Mc/s with horizontal polarization. The e.r.p. of North Hessary Tor in a south-easterly direction is calculated to be 18 kW on a frequency of 51·74325 Mc/s with vertical polarization. A horizontal polar diagram for North Hessary Tor, based on model measurements, is shown in Fig. 1.

It will be seen from Fig. 2 that there is a carrier-frequency difference of 656·75 kc/s between the two transmissions. This frequency difference is equal to thirty-two times the French line-scan frequency (20·475 kc/s) plus 1·55 kc/s, and is within the video bandwidth of the French system. An offset frequency of 1·55 kc/s from an integral multiple of line-scan frequency will produce a diagonal interference pattern which, if the amplitude is sufficient, can be most objectionable.



THE R.M.S. FIELD, SHOWN AS THE UNIT CIRCLE, CORRESPONDS TO AN E.R.P. OF 16kW

Fig. 1

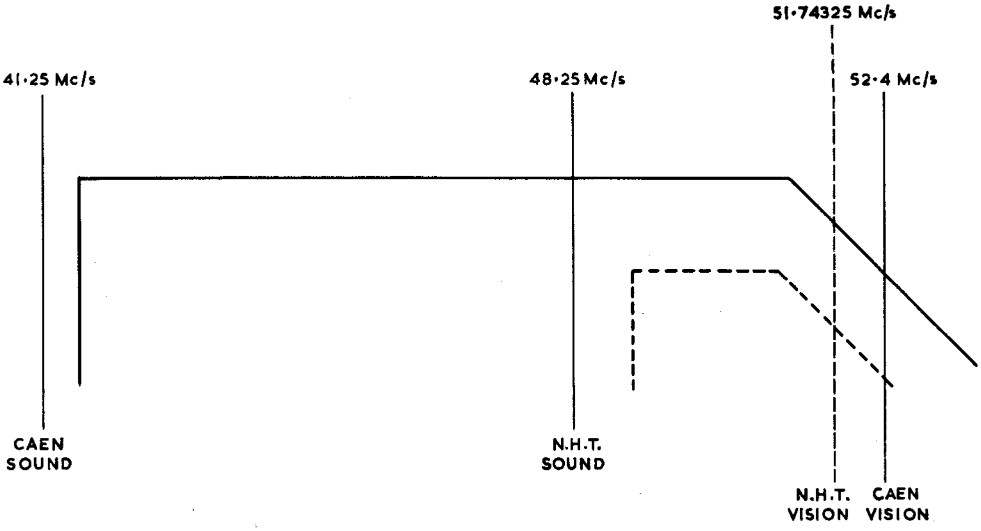


Fig. 2

It is well known that by arranging the offset to have a 1/3 or 2/3 relationship with the line-scan frequency, a material improvement can be achieved, particularly when the frequency difference between the two transmissions is comparatively small. In the case under consideration, where the frequency difference is somewhat larger and the station is operating on a different mains system, the stability of the mains frequency becomes an important consideration. For example, a 1% change in the French mains frequency will have an effect similar to a change of 6·5 kc/s in the offset. No information was available on the stability of the French mains system. A laboratory experiment was arranged to ascertain what improvement could be expected in these circumstances.

It was difficult to obtain reliable estimates of ratios of field strengths of the two transmitters for various places in France. It was therefore considered reasonable to conduct the experiment on the basis of the two subjective criteria of 3½ and 4½ as indicated in Table 1.

TABLE 1

Imperceptible	1
Just perceptible	2
Perceptible but not disturbing	3
Definitely disturbing	4
Most disturbing	5
Unusable	6

The results of these tests are shown in the curves of Fig. 3.

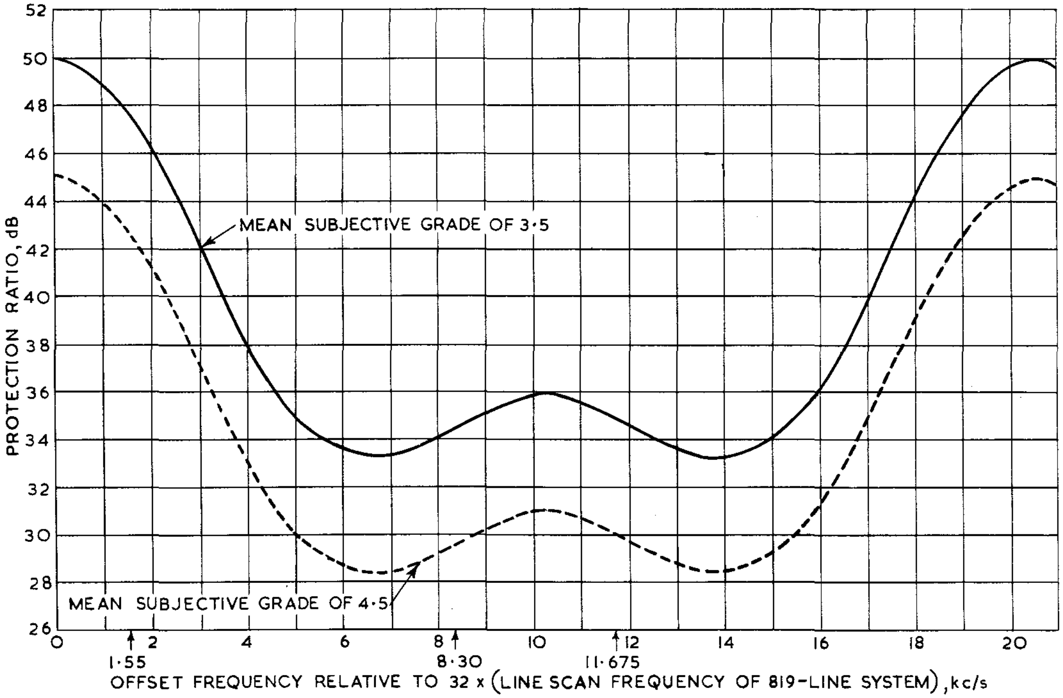


Fig. 3

It will be seen from the curves that improvements of up to 15 dB could be achieved by changing the frequency offset from 1·55 kc/s to either 6·82 kc/s or 13·65 kc/s, the equivalent of 1/3 and 2/3 of the 819 line-scan frequency of 20·475 kc/s.

Of the B.B.C. stations transmitting in Channel 2 one (Holme Moss) uses the nominal Channel 2 vision-carrier frequency of 51·75 Mc/s. The other carrier frequencies are offset from this by ± 6·75 kc/s, that is by two-thirds of the British line-scan frequency. These offsets were chosen to minimise mutual interference in the U.K. The offset at North Hessary Tor is -6·75 kc/s. The only useful change that could be made in the frequency of North Hessary Tor without the risk of increasing interference between B.B.C. stations would be a change by an integral multiple of the line-scan frequency (10·125 kc/s). This would have no effect on the degree of interference between B.B.C. transmissions. Now reduction of the North Hessary Tor carrier frequency by 10·125 kc/s would increase the frequency difference between the Caen and North Hessary Tor transmissions from 1·55 kc/s to 11·675 kc/s. From the curves it is seen that an improvement of about 12 dB is to be expected. Assuming stable carrier frequencies, French mains frequency variations up to ± 0·35 c/s should not detract appreciably from this improvement.

2. OBSERVATIONS IN THE FIELD

It will be appreciated that there are certain unknown factors such as the precise signal to interference ratio being experienced and the stability of the French mains supply, and it was therefore decided to carry out practical observations in the field. For this purpose, the island of Jersey, being considered suitably situated to receive both transmissions, was chosen. A French domestic television receiver was taken from Kingswood for the tests.

Soon after arrival at Jersey, liaison was established with Rediffusion Ltd., who occupy a site near to the B.B.C. station at Les Platons, and permission to use their facilities was obtained. It was fortunate that a three-element Yagi array, aimed at Caen, was available at this site.

It was not possible to operate the wide-band French receiver satisfactorily on Channel 2 at either the Les Platons site or the Rediffusion site, owing to the receiver being overloaded by the local transmitter. Pictures were however received on a somewhat narrow bandwidth receiver consisting of a converted 405-line receiver kindly provided by Rediffusion.

One of the minor difficulties which restricted activities in carrying out observations was that, during the summer months, French television is somewhat curtailed and it is only at the weekend that transmissions take place during the day. For the rest of the week transmissions appear to take place only in the evening from about seven o'clock onwards.

During the first two days (26th and 27th July 1961), conditions were such that the signals received from Caen were very poor and the received pictures were practically useless owing to a very poor signal-to-noise ratio. It was understood from the station staff that these were very unusual conditions. The distance from Caen to Jersey is approximately 75 miles (120 km) mainly over land.

After about three days the signals from Caen appeared to improve, and after investigating various sites on the island, a reasonably satisfactory, but somewhat noisy picture was obtained on the French receiver in the town of St. Helier by courtesy of a local radio dealer who was very willing to co-operate. This dealer also had available a French receiver of another manufacture and it was possible to view both receivers side by side. It is of interest that this second receiver, though made for domestic use, was switchable and capable of operating on any of the five European standards.

Interference was visible on both receivers at between grades 3 and 4.

Arrangements had previously been made by Transmitter Department to provide North Hessary Tor with facilities to enable frequency changes to be made and a variable frequency drive had been installed for this purpose. Contact was made with the station and instructions were given that at specified times the frequency should be changed from the existing offset of −2/3 line-scan frequency (−6·75 kc/s) to −4/3 (−13·50 kc/s) and −5/3 (−16·875 kc/s).

A distinct improvement, estimated to be equivalent to a reduction of at least 10 dB in the interference level, was observed on both receivers.

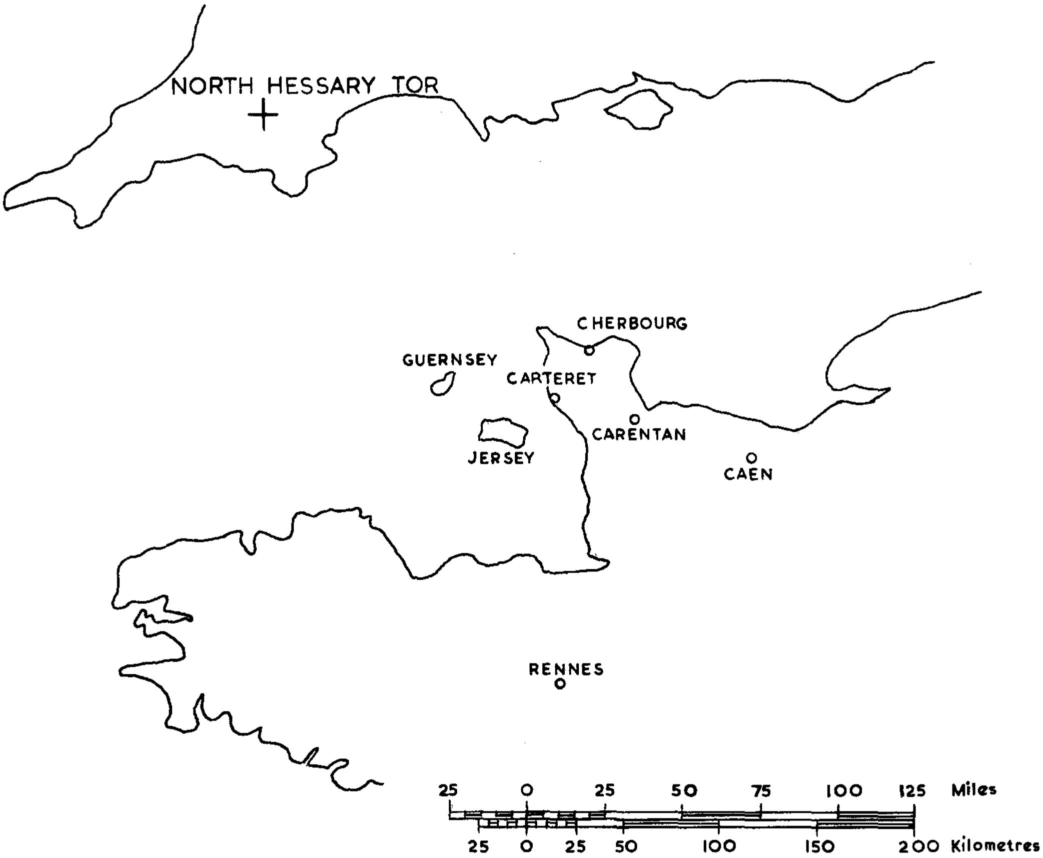
It should be noted that at times, reception in Jersey from Caen was subject to interference during a period when the B.B.C. transmitters were off (Sunday morning when Caen was radiating a church service). Conversely, the signals from North Hessary Tor, received via the microwave link from Guernsey, were also subject to interference when Caen was off. The source of this interference was not known; it was very variable in both character and amplitude.

Throughout the visit very satisfactory pictures were being received on the French receiver using the French Channel 5, from the transmitter at Rennes (164·0 Mc/s).

As the pictures received from Caen during this period were not representative of what would normally be expected in the service area of a transmitter, it appeared desirable to view television in areas of France likely to be affected by the interference. Accordingly an unofficial visit was made to the Cherbourg peninsula by the writer, in the guise of an English tourist interested in French television.

A visit was first made to Carteret on the western side of the peninsula (see Fig. 4). This is a rather small coastal village and there did not appear to be any television available in the usual places for public viewing, such as hotels, cafés or shops. On looking around very few television aerials were seen to be installed on private dwellings.

A train was taken to Carentan, which was considered to be a more likely town some 25 miles (40 km) to the east and 40 miles (63 km) from the transmitter. Television was considerably more popular in this area, and after locating a hotel with television available, it was possible to view a good picture on a 21 inch receiver in the lounge, over a period of some five hours. During the whole of this period, interference from North Hessary Tor did not exceed the subjective criterion of "just perceptible" (grade 2).



Topographical information based upon the Ordance Survey map with the sanction of the Controller of H.M. Stationery Office. "Crown Copyright reserved".

Fig. 4

Before leaving Jersey, instructions had been given to North Hessary Tor to change frequency at half-hourly intervals and at the appropriate times the interference pattern became invisible.

It is of interest to note that all the television aerials seen in the district were either three or four-element Band I Yagi arrays at an average height of about 40 feet (12·2 m).

A further visit was made to Cherbourg at the northern end of the peninsula. Owing to the limited transmission times it was not possible in the time available to see pictures, but enquiries were made at two local radio dealers. From discussions it became apparent that reception from Caen was somewhat unsatisfactory because of interference, but it was not possible to obtain more information on this point. It was however understood that excellent pictures were being received in the district from the 5 kW Band III transmitter situated some 5 miles (8 km) from the town.

During the short period of three days spent in the Cherbourg peninsula, the impression was gained, that areas to the north are adequately served by the Cherbourg transmitter, while areas to the south and west are served by the Rennes transmitter. Around the town of Carentan in the central area a satisfactory service was being received from Caen. It is admitted that conditions might well vary from time to time, whereas these remarks can be based only on the evidence available. There was not sufficient time available to make further observations along the Normandy coastal area and it is possible that the interference from North Hessary Tor may be more severe in these parts.

3. CONCLUSIONS

During the visit to Jersey, reception from Caen was not as good as was at first expected, while reception from the Band III transmitter at Rennes was very satisfactory.

From the evidence it would appear that reception of television in the Cherbourg peninsula was satisfactory, but there may be other areas for example, along the Normandy coast, where interference may be more serious.

In order to minimise the effects of interference that may be experienced in other areas, it is recommended that the frequency of North Hessary Tor be changed from 51·74325 Mc/s to 51·733125 Mc/s which means increasing the existing offset by 10·125 kc/s. From the point of view of reception conditions in this country, this change will make no difference to the protection already provided. It will, however, increase the protection against interference for receivers in France by about 12 dB.

4. ACKNOWLEDGEMENTS

The writer wishes to thank the staff of S.E.T's department for their assistance in providing the variable frequency drive equipment.

Thanks are also due to the staffs of North Hessary Tor and Les Platons, and to Mr. Harrison of Rediffusion Ltd., for their co-operation in this investigation.

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